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Architecture for a new efficiency

Architecture without occupancy

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Synopsis

The 21st century society is proven to be addict to instant gratification and permanent comfort. In the search of this new efficiency, we became technology-dependent in almost every field of our lives. Urban planning and architecture are not alien to this phenomenon.

In USA's central belt, technology applied to logistics is dramatically changing architecture and, by extension architecture is affecting urban planning. New vast ghost cities are emerging in which architecture is inhabited solely by robots. A technology created by humans has expelled humans from architecture.

Simultaneously, cities are being deprived of productive and distributive functions, generating empty spaces that need to be fulfilled.

This is a two-speed phenomenon: productive technologies inexorably speed up in the digital world, whereas transportation systems are yet analogic-dependent. Architects need to confront both the urban and architectural challenges emerged from this new reality and give a physical response to the irrelevance of human scale.

Key words: Technology, automation, efficiency, logistics, architecture.

1. Introduction

The present research tries to analyze the impact of technology in the living conditions of our society: from costumers' habits to the architectural response to the new requirements and technological improvements. Moreover, the research addresses the ethical and even physical consequences of our decisions as architects.

The research is motivated by the reflections made by Rem Koolhaas on the transformation of the countryside in western countries due to the implementation of technology in the productive and agricultural sectors. Through his perspective the research walks through the "re-evolution" of the countryside, the emerging dystopic panorama and the paradigm shift around the concepts of "city versus countryside"

Within this context, the research deepens the development of the logistic industry worldwide through the work of researchers such as Clare Lyster (Principal at CLUAA, Chicago, Illinois) or Jesse Lecavalier (University of Minnessota). Focusing on specific cases, such as Walmart or Amazon in USA, and Alibaba in China, the research analyzes the effects of the implementation of technology in the architecture and the territory, as well as the effects in the affected socio-economic environments.

2. Twenty first Century's demands

Nowadays society is addict to comfort. We became instant "consumers": we expect instant rewards or instant and accurate services and we even expect "home delivery". In this new online shopping paradigm, consumers expect ever-faster delivery of the products they order. With the help of technology, sophistication of product handling has improved to fulfill consumers' expectations of reception from several days to "next day" or even to "same day". These instantaneous expectations are straining the current distribution/logistics model.

In this supply chain, Distribution / Fulfillment centers have acquired a high level of efficiency. However, there is still a challenge with the inefficient transport of goods. "It is an archaic distribution model built on a fragmented and inefficient network that cannot meet the increasingly tight time frames for delivery to consumers." (NAIOP, 2013)

Consumer expectations for ever-faster delivery times might require the Distribution Centers of the future to be located closer to those consumers and/or to logistics partners within the logistics chain. However, the spatial requirements of these new DCs seem not to meet these requirements, due to their large scale, their urban needs and the elevated degree of automation. This is where we confront our first dilemma, as urban planners and architects

Nevertheless, as intellectuals, we might confront a previous dilemma: should architecture promote and encourage these values that are installed in our society? Some prominent figures such as Rem Koolhaas, one of today's foremost thinkers and architectural forecasters, consider that "comfort is overrated". He has declared that security, comfort and sustainability have substituted the values of "Freedom, Equality and Fraternity" that promoted the

French Revolution. (El País, 2016). His provocative statements search to generate a reflection on the principles that might rule our society and how could architecture can contribute to resolve the conflict.

3. Technology to fulfil those demands

There are two specific sectors where the incorporation of technology to the productive processes have generated mayor changes, affecting even the configuration of landscape and architecture itself.

The first productive sector is agriculture. In the last decade, farmers are diversifying and technifying their processes. Land husbandry is now a digital and computerized practice: farmers can now-a-days work on their laptops from anywhere in the world. In terms of the working system, the countryside is becoming very similar to the city. Dairy farming and animal husbandry are also increasingly automated. Agriculture is being increasingly subordinated to the market economy and landscape is being digitalized (Fig. 1). This new digital frontier is changing the way we understand even the most far removed environments. For instance, there is a software, Helveta, which enables people in the Amazon to identify and track every single tree. Tribesmen have turned into digital informers who are able to inventory their land. A new order of rigor is appearing everywhere; a hyper-cartesian order is being imposed on the countryside, as it was previously imposed on the cities. As Rem Koolhaas explains: "In spite of our active disinterest (and perhaps because of it) the countryside has become the most radically changing part of our physical environment, through our own massive interventions, multiplied by the colossal transformation that global warming is already imposing". Radical transformations are no longer happening in the cites, but in the countryside, that is acting as a white canvas with no rules or limits for interventions.



Figure 1. Grandview feedlot (30-65.000 head of cattle), Idaho. Source: OMA.

The second productive sector is the logistic industry. Over the past 20 years there has been a huge proliferation of cartesian boxes (more than 14 million square feet) following a number of competing grids. The efficient manage and distribution

of products to consumers all over the world with immediacy criteria has led to the implementation of technology in Distribution Centers. In these centers, many of the tasks are already being developed by robots (such as searching for products, transportation, inventory), whereas human workers stand at the end of the productive chain as “pickers”. Although it’s too early to tell the role of this industrial revolution in the warehousing industry, it is expected that these technological improvements might progressively take away most of the “human” jobs (Fig. 2). Future DCs are predicted to count on minimal human presence: only for supervision, surveillance and occasional maintenance.

One of the most radical examples is the Alibaba’s warehouse in Huiyang, China. With 20.000 m², there are 100 robots (AGV: automated guided vehicles) that receive instructions via Wi-Fi. They can travel at speeds of up to 1.5 meters (5 feet) per second and carry up to 600 kilos at one time. In a traditional warehouse, a worker might be expected to sort through 1,500 products during a 7.5-hour shift and fetching each item might require them to walk 27,924 steps during that time. “Now, thanks to the mobile robots, the clerk could sift through 3,000 products in the same shift, while only taking a significantly fewer 2,563 steps a day,” said the Alibaba Group company in a statement. Of course, the number of employees needed is almost insignificant (Fig. 3). This creates a new challenge for architects, as the design parameters shift drastically: the uninhabited architecture.

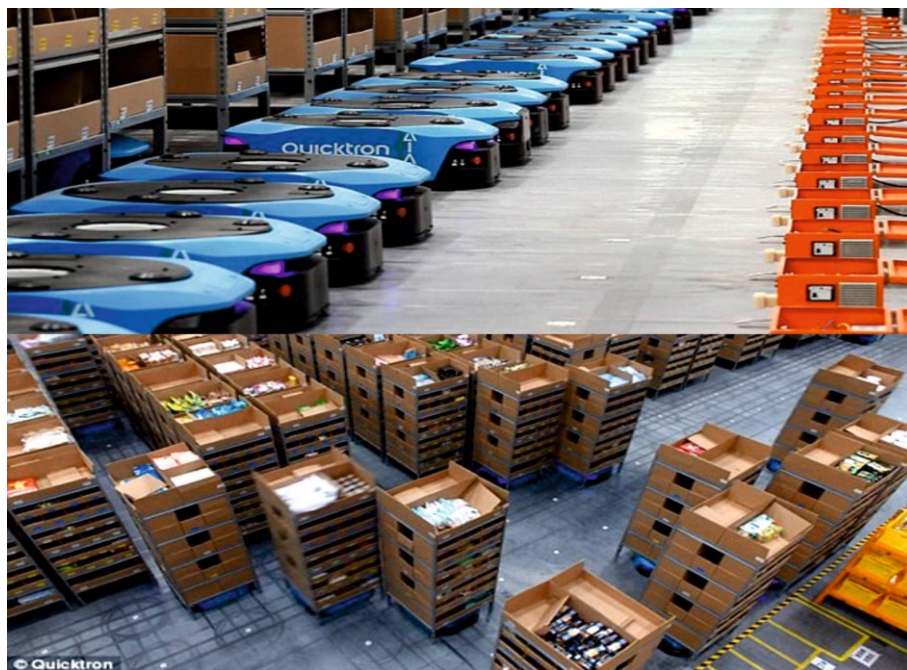


Figure 2. Alibaba’s Headquarters, Huiyang, China. Source: Quicktro.

4. Landscaping as a result of technology

But not only architecture is influenced by this new paradigm, it also affects the landscape and the territory where it’s implemented. This phenomenon is being studied by renown think tanks in USA and Europe.

Clare Lyster is the principal at CLUAA, a research-based design practice in Chicago operating at the intersection of architecture, landscape and planning.

In recent times the office has been researching on the issue of logistics. She states that, in the twenty first century the processes of globalization are playing a prominent role in urban planning: "systems and flows are more critical than form in generating space (...) While economics, transportation, information and technological continuity conceive the globe as a singular and unified construct, at the same time globalization has wielded a de-centering and discontinuity of the global spatial field". (ACSA, 2011)

This de-centralization is being observed by other authors and it will dramatically change the conception of "the city versus countryside". One of the most iconic examples is Rem Koolhaas, whose increasing interest in the processes developing in the countryside have led his think tank AMO to launch a research project on the subject with his students at the Harvard Graduate School of Design that will culminate in an exhibition at the Guggenheim Museum in fall 2019.

In the words of its curators "Countryside: Future of the World will present speculations about tomorrow through insights into the countryside of today. The exhibition will explore the effects of genetic experimentation, artificial intelligence and automation, political radicalization, mass and micro migration, large-scale territorial management, human-animal ecosystems, subsidies and tax incentives, the impact of the digital on the physical world, and other developments that are altering landscapes across the globe". (Guggenheim news release, 2017).

Koolhaas's concern on this issue emerged more than 15 years ago. He considers that there is a technological revolution taking place in the countryside that has been historically neglected by architects. In the exhibition "Cronocaos", at the 12th Edition of Venice Biennale (2010), he exposed the issue of preservation and the impact that globalization has in the territory. There are two opposite processes taking place at the same time: there are massive migration flows from the countryside to cities, especially in Southeast Asia whereas in North America and Europe, the productive and industrial tissue is more and more being located in the countryside deploying a dystopian panorama.

The radical transformation of the countryside has gone unnoticed for architects, that over the past 20 years have been focusing their analysis and efforts in urban environments. Globalization and technology have affected the productive systems and also have dramatically changed agriculture. "Agriculture in America is more and more concentrated on a central belt that runs from the south to the north," said Koolhaas. "And there is a kind of seasonal operation where larger and larger machines that are used for harvesting are so big that no individual farmer can actually own one. They become like armada of machinery that that is so expensive that it has to function 24 hours a day. (...) That is concentrating a large percentage of all the production in America in a central zone."

In the central belt of USA, that Koolhaas was referring, traditionally agricultural areas are suffering a radical transformation. This new technology that emerged in agriculture can only be afforded by big fortunes, whereas small farmers are confronting a dramatical impoverishment and are being force to

change their source of livelihood to the production and distribution industries that are simultaneously emerging in that area.

As the former farmer Philip Alfano explains “Historically we’ve been an agricultural- based economy. With our proximity to the Port of Oakland and rail lines, we’re now emerging as a logistics and supply chain hub.” (The California Report, 2017). This article explains the transformation suffered at the Central Valley in California, where the agricultural sector has been left in the hands of a few large landowners, while the distribution and business sector are burning, in part due to the growth of Amazon or big national companies such as Walmart, CVS, Whole Foods, Albertson, etc... Local governments have welcomed the boost in employment and they are even investing in training programs but, at the same time, many specialist are questioning this structure in the long term, as the working conditions are usually uncomfortable, salaries are low as well as the success expectations (Fig. 4). They mean also a threat to employment at traditional retail companies.



Figure 3. Amazon Distribution Center, Phoenix, USA. Source: AP Photo/Ross D. Franklin.

In addition, many specialists confirm that the initial employment boom of these distribution industries might decrease rapidly and show a growing concern about the potential impact of automation.

Rem Koolhaas considers that one of the factors that might explain Trump’s victory in the past 2016’s elections is this progressive impoverishment of the rural working class in USA and the effective lost in life quality and expectations: "I was not completely surprised when Trump won. (...) I'm not saying that Trump was inevitable but the scale of upheaval in the center of America made it very understandable for me that something else was going to happen." (Dezeen, 2016)

Koolhaas also addresses the issue of the effects of globalization and technology in the inner regions of North America and he is specially critic with the role of Silicon Valley: “As an architect, I am fascinated by the physical

effects of Silicon Valley's virtual propaganda. A new scale is emerging in data centers and distribution centers. Buildings are becoming bigger and bigger, the largest so far being Tesla's battery-making Gigafactory near Reno, Nevada. As they are increasingly automated and robotized, none of these buildings has large human populations. The human scale could become irrelevant." (The Economist, 2018)

He is concerned about the size these server farms, fulfillment centers or battery factories are reaching, as the surface they occupy is as big as a city but they will never have its density, which leads us to a brand new urban and architectural typology emerging in front of us. As architects we must take part in this transformation.

5. Architecture as a result of technology

In summary, there are two fundamental issues to address as architects: the location of these huge macro-structures and the immediate effects on the landscape, and the architectural approach to this new condition.

Regarding the location of the DCs (Distribution Centers), there are different opinions on the issue, due to the production technologies and the transportation means, as it was especially tangible in the competition launched in 2013 by NAIOP (one of North America's largest, most prestigious and valuable commercial real estate organizations). The competition sought concepts for the Distribution/Fulfillment Center of the Future. Several architects were to conceptualize and design the physical "goods exchange" structure that will accommodate distribution, fulfillment, and retail functions in the year 2020. Surprisingly, the two winners had radically opposite proposals, which gives us a clue of the challenge this issue brings to architects and urban planners.

The Ware Malcomb concept proposes a structure with the typical large footprint of Distribution Centers; its innovations are focused on spatial redistribution and materials handling within the building in order to obtain the maximal efficiency possible with the current technology. The bet was to locate the DC outside the cities.

In contrast, Riddell Kurczaba envisioned a vertical Distribution Center suitable for an urban setting (Fig. 5). Its "Swarm" concept moves the storage and distribution functions into the core of a 25-story mixed-use building, which also houses residential, office, and retail space and integrates goods movement that makes use of existing transit systems such as metro and light rail. This proposal departs from a strong assessment: "Distribution is broken. In an era of liquid digital communication, the traditional structure and roles of physical warehousing and retail distribution exist in a state of flux. New modes of consumption (e-commerce, m-commerce, and s-commerce) have challenged the role of the traditional retail storefront and put strains on the infrastructure and distribution systems which support it." (Industrial Building of the future, 2013).



Figure 4. 2013 NAIOP Winners, Distribution Centers of the Future, USA. Source: NAIOP.

A second important issue is the typological response to the new needs emerged. It is important to deepen in the consequences that the above-mentioned factors (globalization, artificial intelligence, automation, political radicalization, digital era...) have not only the landscape but in the conception of space and the new architectural typologies that might emerge. There are some interesting questions to develop, such as: “how architects should confront the design of a space that would be inhabit by robots rather than humans” or if “the future architecture might not need human presence anymore”.

Contrary to what has happened with the countryside, many architects are fascinated and/or “anxious” about infrastructures. Rem Koolhaas is not an exception; he talks about a paradigm shift. It might seem as the future of these Distribution Centers is not so much finding “cheap” workers but actually becoming institutions without workers. In his own words, “In some of today’s giant greenhouses light is not admitted for the pleasure of humans but reduced to that narrow part of the spectrum that promotes growth in plants. It is a return to extreme functionality. Given the massive building in the countryside and the reduction of human presence, architecture can become more radical. Today, humans need the color beige: we cannot stand stark contrast or color intensity. In the new technological spaces, however, you get a shock of intensity. Coding is creating its own aesthetic”.

We are witnessing the emergence of a new sublime. And this will have repercussions not only for architecture but also for citizens more broadly. It has a beauty that is in itself really amazing” (Fig. 6). (The Economist, 2018).



Figure 5. Facebook server farm (91.440 m²), Luleå, Sweden. Source: OMA.

The radicality of these boxes' interiors turned unpredictable for architects. They are characterized for such a high level of abstraction and codification and such a distance from human scale or any concept of spatial articulation that we couldn't expect it. Definitely, these new Distribution Centers are not designed for the humans that might inhabit them but for the robots, in order to increase the production rate exponentially. This is the description of one of Amazon's fulfillment centers (Fig. 7): "As soon as you pass into the building, you are enveloped in sound. Noises made by human workers and machines ricochet off concrete and metal into an indistinguishable industrial din, punctuated occasionally by the beep of a forklift backing up. Conveyor belts compose the base of this droning. They snake around the entire building, taking abrupt turns, spiraling from ceiling to floor, alternating from metal rollers to long treadmills, speeding up, slowing down, crisscrossing and finally converging like lanes on a large and complex freeway. An endless stream of brown boxes rides these pathways, traveling from human — the pickers who fill them with items — to the bays of trucks waiting outside." (The California Report, 2017).



Figure 6. Amazon Distribution Center, DuPont, USA. Source: Amazon.com.

This condition of ubiquitous big box threatens architecture with irrelevance. The parameters are so far from conventional architecture that it is extremely difficult to handle. Light, program, atmosphere, temperature, comfort, accessibility...are substituted by efficiency, flexibility, accuracy and promptness. In his book "The Rule of Logistics: Walmart and the Architecture of Fulfillment", Jesse LeCavalier develops an in-depth research on the functioning of Walmart Fulfillment Centers. In his opinion, logistics has taken over from mass production and become the new organizational paradigm for our age (Fig. 8). In opposition to any idea of architecture as autonomous form, the exterior of this "big box" adapts to make the store tolerable whatever the local condition. The paradox is that the goal of these structures is to disappear through camouflage while obtaining the most efficient flow of merchandise and information across space and time. The discipline of architecture is progressively addressing this challenge and giving significant responses.

One of the main concerns of this new typo is the protection of the environment, the rational use of the technical and energetic resources, as well as the economic and material savings. As an example, the implementation of bioclimate in the new Distribution Centre of "Farmacias Ahumada" generates a categorical and simple architecture in harmony with the natural environment. The architect, G. Hevia, looks for solutions for the distribution and handling of pharmaceutical products, incorporating the latest operational technologies and Bioclimate solutions.



Figure 7. Distribution Center FASA / GH+A | Guillermo Hevia. Source: G. Hevia.

6. Learning from logistics

These responses are frequently related to the strategies followed previously by the logistics industry, where efficiency and readiness are more relevant factors than comfort, as it has been mentioned above.

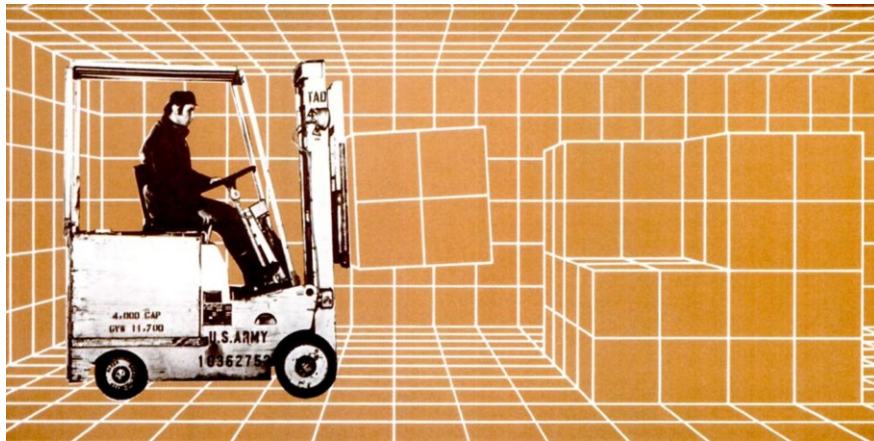


Figure 8. Are Walmart's fulfillment centers avant-garde architecture? Source: University of Minnesota Press.

In the 90's architects started to look at logistics networks as a way to control and enable the flows of material, people and data, which is what characterizes the contemporary urban condition. In recent times, it seems that the architects' interest has extended to the concept of design. In her book "Learning from Logistics" Clare Lyster studies the cases of three huge corporation logistics practices (Amazon, FedEx and Ryanair) and their related infrastructure, architecture and landscapes. These examples are chosen due to their territorial impact and reliance on a combination of digital and physical infrastructure. She explains how powerful these networks are as "urbanizing agents": through their practice, they are able to generate effective and actual changes in the territory. As an example, she describes Ryanair's practice of offering cheap direct flights between peripheral, underutilized airfields, effectively producing a new map of Europe populated by unknown places, creating an "alternative spatio-geographic indexing of the continent". Lyster relates concepts derived from logistics to paradigmatic architecture, landscape, and urban design theory and projects (such as OMA's Downsview Park proposal, Fig. 9) and extrapolates the consequences in concepts such as "site", "plan", "zone", "circulation" and "architecture".

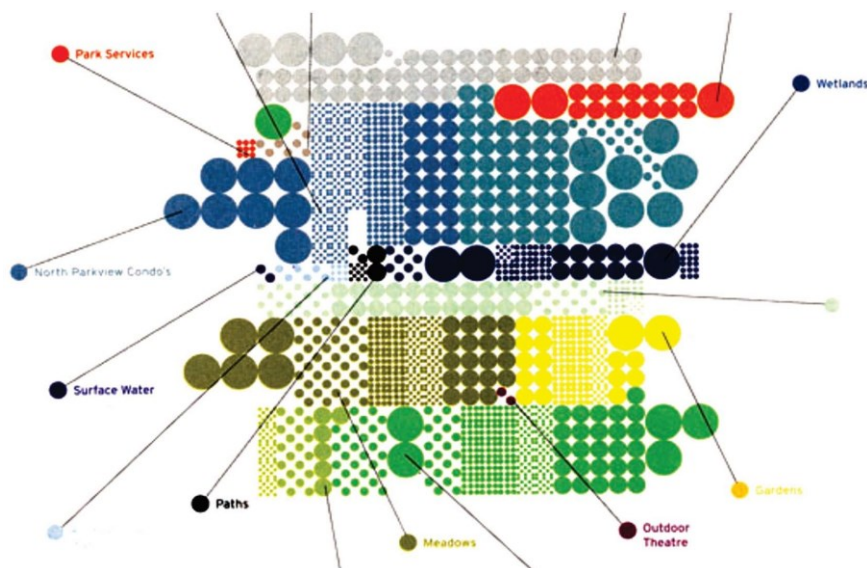


Figure 9. Downsview Park Diagram, Toronto, Canada, 2000. Source: OMA/AMO.

Lyster proposes to work with the “network” as the context, departing from historic interdependencies between geography, identity, and urbanism. To illustrate the “network context concept” she resorts to utopian visions such as Reyner Banham’s “Autopia”, Superstudio or Archizoom (Fig. 10). She also develops an interesting parallelism between the infrastructural “framework” proposals of the Metabolists, and the efficient ground surface distribution in logistics facilities.

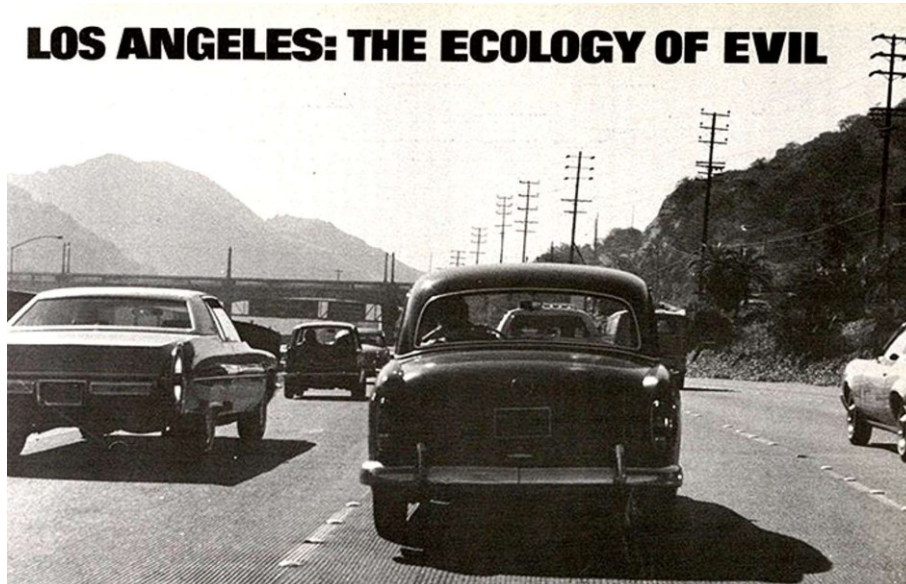


Figure 10. Los Angeles in the 1970s. Reyner Banham’s Autopia. Source: Peter Plagens.

7. Conclusion

The main contribution of this research is to reveal the consequences of the dislodgement of the productive industry to the countryside together with the increasing demands of “immediacy” and “comfort” by society. It is clear that the new social paradigm and the unstoppable development of technologies applied to logistic networks, will end up by transforming the urban condition around the planet.

These are the main consequences identified:

- With the Distribution and Production Centers located outside the city, it is necessary to implement the capacity of distribution lines, which will undoubtedly affect the traffic in the cities and their urban development.
- A new paradigm emerges in the relation between the city and the countryside. The city is no longer the place where radical changes happen. It is in the countryside where architects must face the new challenges and propose a genuine response according to the new parameters.
- Equally, a new architectural typology arises, that responds to many factors, from technological to sociological new conditions.
- This new typo will force the generation of a new urban condition. As Rem Koolhaas declared: “Architecture’s legitimacy has always been based on how it could accommodate, inspire, cherish, challenge, and console

its clients. What will it do to its status if the client evaporates? What will be the new legitimations?" (Flaunt, 2016)

As a result, the redistribution of these functions in the countryside will force architects to make important decisions regarding these new hyper-dimensioned ghost cities ("post-cities", R.K.) created outside the cities and also will encourage them to rethink the "empty" spaces that will emerge in the cities due to the loss of functions previously embedded in their urban tissue. The research shows that the ramifications of the issue are both new and varied and exposes the urgent need that the discipline addresses these mayor topics for the future of our environment.

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Biography

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